infested areas they will not assure a 100 per cent control, but if carefully followed they will prevent serious outbreaks and control the disease sufficiently for practical purposes.

EDMUND B. LAMBERT,
*Associate Pathologist, Bureau of Plant Industry.*

## MUSHROOM Growing Risky Without Control Action for Insects and Mites

The growers of the cultivated mushroom *Agaricus campestris* have long been troubled with insect pests and mites, the infestations of which have gradually increased with the localization and growth of the industry to the point where they have made mushroom culture rather hazardous unless measures of prevention and control are constantly practiced.

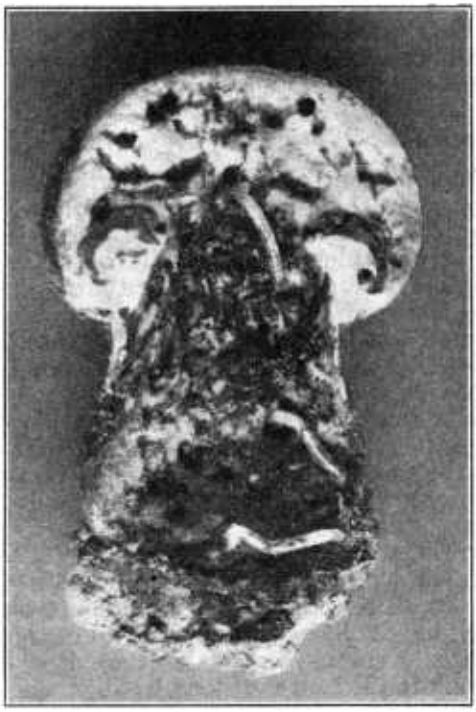

FIGURE 120.—Mushroom button showing maggots of fungus gnats and damage done chiefly by them

The chief pests causing commercial damage to mushrooms are the fungus gnats, mites, and springtails.

In general, the fungus gnats, of the genus Sciara, are productive of the most injury to the mushroom industry. They are prevalent in almost every type of mushroom house or cave, since they enter, as a rule, in the compost when it is taken into the houses. The larvae or maggots of these flies cause injury both by destroying the mycelium in the beds and by feeding on the small mushrooms, which they completely devour in many instances. These maggots are also capable of rendering the large sporophores unfit for market by tunneling upward through the stem and cap. (Fig. 120.) The adult flies often transport injurious mites, which attach themselves to the bodies of the flies, from one mushroom house to another and they also aid in the dissemination of some diseases of mushrooms.

The mites, while not so prevalent in general as the fungous gnats, are capable, nevertheless, of causing serious losses, once they become established in a range of mushroom houses. The mushroom mite proper, *Tyroglyphus lintneri* Osb., feeds on the mushroom, producing dark pits which result in decay, destroy the mycelium in the beds, and cut off the feeder "root system" (fig. 121) so that the sporophores do not mature, resulting in decreased yields. A severe infestation of this mite was experienced by an Ohio grower during the past season, resulting in a crop damage of approximately $25,000.

It is much more widely distributed, apparently, than the mite *Linopodes antennaepes* Banks, which was recently found causing commercial damage to mushrooms in several plants and which resulted in a loss of approximately $50,000 to one grower.

Springtails cause very little damage to mushrooms in the East, but are one of the most serious pests with which the growers operating in the sandstone caves of the Northwest have to contend. While the species found in the sandstone caves has never been described in this country and apparently is not present in the East, it is doubtful whether it would cause a great amount of damage in the modern eastern houses on account of unfavorable atmospheric conditions for rapid development and reproduction.

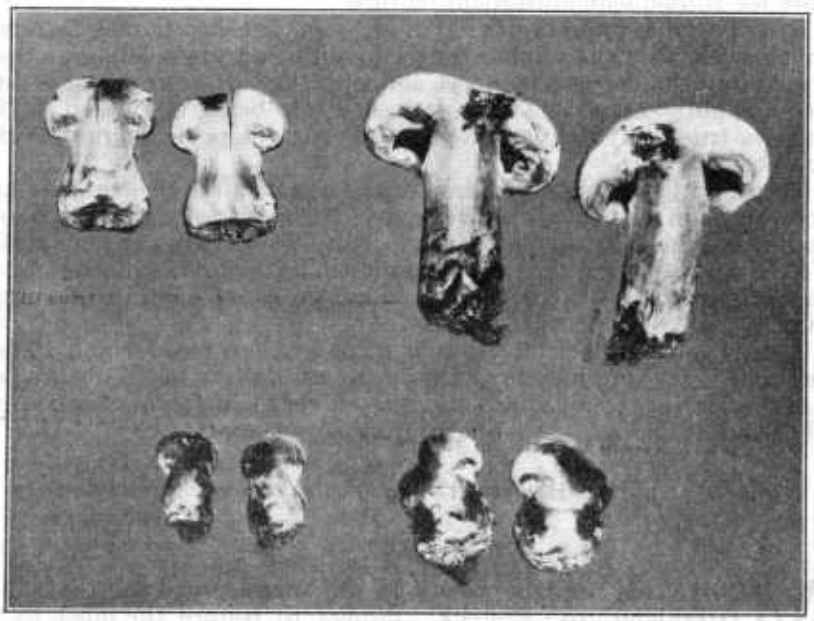

FIGURE 121.—Mushrooms showing damage caused by the mushroom mite, *Tyroglyphus lintneri*

## Measures of Prevention and Control

In view of the extreme sensitivity of the mushroom mycelium as well as the mushroom itself to most fumigants, it is necessary to take certain precautionary measures prior to placing the spawn in the beds in order to prevent heavy infestations of these pests and subsequent damage to the crop.

Experiments have shown that the manure, if properly composted before it is put into the beds in the house, will undergo a secondary decomposition process and heat up sufficiently (if aided by forced circulation) to either kill the pests in the compost or drive them to the surface where fumigants can be effectively used. Forced circulation is obtained by the use of electric fans of the oscillating type while the compost is undergoing its secondary decomposition process in the beds. By means of two 16-inch fans it is possible to equalize the air temperature all over the house and to get the temperature in the compost fairly even in all the beds, making it possible to kill off

the various pests by fumigation while the temperatures are at the peak.

Calcium cyanide, at the rate of 1 pound per 1,000 cubic feet of air space, scattered on the floor in the alleyways, has been most widely used to date, but the burning of sulphur, in view of its cheapness and its double rôle as a fungicide and insecticide, is gradually replacing cyanide for this purpose. The practice of burning sulphur at the rate of 2 pounds per 1,000 cubic feet of air space while the compost is at its peak heat in the beds and leaving the house closed for five hours after all the sulphur has burned has proved to be very effective against any pests which may inhabit the house at this time, and, judging from results of yield tests, it has not injured the compost for subsequent mushroom culture.

Results of determinations of hydrogen-ion concentration have shown conclusively that the sulphur fumes do not penetrate much more than 1 inch into the uncased compost and that the surface compost is rendered slightly more acid than it was before being fumigated. The same is true of hydrocyanic-acid gas as regards penetration into the compost.

To prevent possible infestation of the houses after the compost has gone through its heat in the beds and has been fumigated, the doors and ventilators should be screened with 30-mesh copper-wire cloth. To prevent rapid development and multiplication of insects and mites the temperature of the house should not go above 55° F. while cropping.

A dust consisting of 60 per cent of pyrethrum powder and 40 per cent of a finely ground clay, when used at the rate of 2½ ounces per 1,000 cubic feet of air space, has proved very satisfactory for control of the adult flies and does not injure the mushrooms.

O. E. Gahm,
*Assistant Entomologist, Bureau of Entomology.*

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## Musk Oxen Brought from Greenland to Restock Alaska's Tundra Lands

In the summer and fall of 1930 a project to restore the musk ox to Alaska, where formerly it lived in small numbers, resulted in the transportation from northeastern Greenland of a herd of 34 young animals. These were captured by a Norwegian collector, and after transshipment in Norway traveled on an ocean liner to New York. Following a 30-day quarantine period, the animals were taken by rail to Seattle, thence by ship to Seward, Alaska, and again by rail to the reindeer experiment station maintained by the Bureau of Biological Survey near Fairbanks. Here they are being held for feeding and breeding studies with a view to the eventual liberation of stock in suitable parts of the Territory to add another large animal to Alaska's wild-life resources.

When the liner tied up at a Brooklyn wharf about the middle of one of September's warmest days, these hardy animals must have wondered, in their silent, stolid way, what next adventure was in store for them. Taken from their associates, and in most cases from their mothers (for half the individuals were only about 4 months old), put into strong crates barely large enough to allow for turning around, shipped to